**Case 1**

A 66-year-old retired male presents with dyspnea on exertion. He first noticed the shortness of breath several months ago but was not concerned because it seemed so minor; he attributed it to aging. During the past few months, however, the dyspnea on exertion has gradually worsened.

The patient has no other symptoms of respiratory or cardiac disease. His medical history is unremarkable except for

* an old back injury (compression fracture of L4) sustained while working as an electrician at a local shipbuilding facility and
* a 25 pack-year history of smoking, though the patient quit smoking 5 years ago.

On physical examination, the patient is in no apparent distress. Auscultation reveals bibasilar end inspiratory rales. There are no signs of cyanosis, no clubbing of the fingers, and no peripheral edema. Heart sounds are normal, as are the results of the rest of the physical examination.

**Case 2**

A 35-year-old man visits your family practice office near a large Midwestern city. He has complaints of "allergies" and sores on his hands and arms. Over the past 2 to 3 months, the patient has noticed the onset of runny nose, sinus drainage, dry cough, and occasional nosebleeds (both nares intermittently). No prior history of allergies exists. He has also had occasional nausea and is concerned because the sores and minor skin cuts on his hands do not seem to heal. The patient denies having fever, chills, dyspnea, or change in bowel or bladder habits, and he has not noticed excessive thirst or easy bruising. He recently began losing his appetite and losing weight without dieting.

With the exception of the complaints mentioned, review of systems is otherwise unremarkable. The patient has used various over-the-counter remedies for his respiratory problems without relief. He did, however, note significant improvement in symptoms when he visited his sister in Chicago for 5 weeks at the end of the summer.

Medical history reveals only usual childhood diseases. Other than over-the-counter (OTC) decongestants, he is taking no medications. He denies use of illicit drugs, but admits to occasional social use of alcohol. For the last 16 years, he has smoked 1 pack of low-tar cigarettes a day.

The patient has been employed as a mathematics teacher for 13 years; he usually works summers as a self-employed handyman. His hobbies include reading and tennis. Two years ago he moved into a ranch-style house several hundred yards from a small manufacturing plant; a small pond sits between his house and the plant. The house has central air conditioning and gas heat; it is supplied with well water and uses a septic sewage system. Four months ago, the patient began digging up the sewage system to make repairs. Shortly after he began digging, he first noticed the sores on his hands and forearms.

Physical examination reveals an alert white male with 10 erythematous papules of 5-10 millimeters in diameter located bilaterally on the dorsal forearm and hands; edema of the hands is present. The dermal lesions show small circular areas with shallow ulcerated centers. Ear, nose, and throat examination is unremarkable, and chest examination reveals a few scattered rhonchi that clear with coughing. His liver is slightly enlarged and tender to palpation. Cardiovascular, genitourinary, rectal, and neurologic examinations are unremarkable.

Initial laboratory findings include evidence of 2+ proteinuria and hematuria, and slightly elevated bilirubin, aspartate aminotransferase [AST]; known as serum glutamic-oxaloacetic transaminase (SGOT), and alanine aminotransferase (ALT); known as serum glutamic-pyruvic transaminase (SGPT). Scrapings of the dermal lesions, done with potassium hydroxide preparation, show no fungal elements on microscopic examination. A nasal smear for eosinophils is within normal limits.

|  |
| --- |
| **Case 3**  A 67-year-old man is brought to the Emergency Department (ED) of a small community hospital where you are the family physician on call. The patient is experiencing ataxia, dizziness, and vomiting. He is hyperventilating. On physical examination, the patient appears well nourished, but agitated and disoriented. There is no odor of ethanol on his breath.  **Vital Signs**  The patient's vital signs are   * blood pressure (BP): 120/80 mm Hg * temperature: 98.5° F * pulse: 80 beats/minute * respirations: 40 breaths/minute   Neurologic examination is otherwise normal with no crucial findings. There is no nystagmus. Abdominal and cardiorespiratory examinations are also normal.  **Additional Information**  The patient's friend brought him to the ED. The friend said the patient complained of dizziness and had begun to vomit late last night. This morning the patient was hyperventilating and continued to vomit. Both men are retired pilots who teach at the local airport's ground school. Because two other people had collapsed at the airport that morning and were taken by ambulance to another hospital, the friend wonders if the food at the airport cafeteria is responsible. Both he and the patient had hot dogs and coleslaw, but the friend states that he feels fine.  **Results of Lab Tests**   * blood ethanol and drug screen are negative * arterial blood gases **(**ABG) results: pH 7.10; PaCO2=20 mm Hg; PaO2 =95 mm Hg; and Bicarbonate, =8 mEq/L * sodium: 145 mmol/L (normal 135-145 mmol/L (Jacobs DS 1996)) * potassium: 3.8 mmol/L (normal 3.1-5.3 mmol/L) * chloride: 105 mEq/L ( normal 98-109 mEq/L) * BUN: 20 mg/dL (normal 8-18 mg/dL) * creatinine: 1.0 mg/dl (normal 0.6-1.2 mg/dL) * glucose: 80 mg/dl ( normal 65-110 mg/dL) * calculated anion gap: 32 (normal 12 to 16)   Normal values may vary from lab to lab and depend upon the elevation above sea level. |

|  |  |
| --- | --- |
| **Arterial blood gases (at sea level and breathing room air)** | |
| Partial pressure of oxygen (PaO2) | 70–100 millimeters of mercury (mm Hg) |
| Partial pressure of carbon dioxide (PaCO2) | 35–45 mm Hg |
| pH | 7.35–7.44 |
| Bicarbonate (HCO-3) | 21–28 milliequivalents per liter (mEq/L) |
| Oxygen content (O2CT) | 15%–23% (15–23 milliliters [mL] per 100 mL of blood) |
| Oxygen saturation (O2Sat) | 95%–100% |
| **Case Study, Second Patient** | Less than 30 minutes later, a 4-year-old boy is brought to the ED. On examination you find a sleepy but arousable child. There is no evidence of trauma or focal neurologic signs. Abdominal and cardiorespiratory examinations are normal.  **Vital Signs**  The patient's vital signs are   * BP, 94/76 mm Hg * rectal temperature: 98.5° F * respirations: 12 breaths/minute * pulse: 78 beats/minute   **Additional Information**  The parents tell you they were attending a local fliers' club luncheon at the airport. When they found the child staggering and incoherent, they rushed him to the ED. On the way, he vomited in the car.  **Results of Lab Tests**  You order the same laboratory tests for the child that you ordered for the 67-year-old patient. The tests reveal that the child is   * hypoglycemic * has slight acidosis * an anion gap of 13   **Additional Information**  You contact the local health department. You are told they are investigating the earlier incidents at the airport. They suspect the airport's water supply is contaminated, but they have not identified the contaminant. |

**Case 4**

A father brings his two-year-old boy into a pediatrician's office for a routine well-child visit. From the father, the doctor learns that the boy's parents are divorced and that he generally lives with his mother and her parents. (The mother had to accompany her parents to her aunt's funeral this weekend and therefore could not make the appointment.) The doctor makes a note of this information.

The pediatrician examines the boy and finds no abnormalities. The boy's growth and development indicators are within normal limits for his age.

Three years later, concerned that her child is hyperactive, the mother brings the same child, now five years old, to your office (his previous pediatrician recently retired). At a parent-teacher conference last week, the kindergarten teacher said that the boy seems impulsive and has trouble concentrating, and recommended evaluation by a physician as well as by the school psychologist. The mother states that he has always seemed restless and easily distracted, but that these first six months in kindergarten have been especially trying.

He has also complained recently of frequent intermittent abdominal pains and constipation. The mother gave him acetaminophen for stomach pains with little change, and has been giving him a fiber laxative, which has reduced the frequency and severity of constipation. She wonders if the change to attending kindergarten has a role in his increased complaints.

Family history reveals that the boy lives with his sister, mother, and maternal grandparents in an older suburb of your community. The child visits with his father one weekend a month, which is working out fine. However, he seems to be fighting more with his sister, who has been diagnosed with attention-deficit disorder and is repeating first grade. Since the mother moved in with her parents after her divorce four years ago, she has worked with the grandfather in an automobile radiator repair shop, where her children often come to play after school. She was just laid off, however, and expressed worry about increasing financial dependence on her parents. She also worries that the grandfather, who has gout and complains increasingly of abdominal pain, may become even more irritable when he learns that she is pregnant.

Her third child is due in 6½ months.

On chart review, you see that the previous pediatrician examined the boy for his preschool physical one year ago. A note describes a very active four year old who could dress himself without help but could not correctly name the primary colors. His vision was normal, but hearing acuity was below normal according to a hearing test administered for his preschool physical. The previous doctor noted that the boy's speech and language abilities were slightly delayed. Immunizations are up to date.

Further history on last year's visit indicated adequate diet, with no previous pica behavior. Hematocrit was diminished at 30%. Peripheral blood smear showed hypochromia and microcytosis. There was no evidence of blood loss, and stool examination was negative for occult blood. The diagnosis was “mild iron deficiency anemia,” and elemental iron 5 mg/kg per 24 hours (three times daily after meals) was prescribed. The family failed to keep several follow-up appointments, but the child did apparently complete the prescribed 3-month course of iron supplements. He receives no medications at this time and has no known allergies.

On physical examination today, you note that the boy is in the 10th percentile for height and weight. The previous year he fell within the 20th percentile. His attention span is very short, making him appear restless, and he has difficulty following simple instructions. Except for slightly delayed language and social skills, the boy has reached most important developmental milestones.

**Case 5**

A two-month-old female infant is brought to your clinic in a rural area for a routine well-baby checkup. According to the child's chart, she was delivered two weeks early because of maternal toxemia. There was no neonatal distress; her birth weight was 7 pounds and 2 ounces.

Today, the mother states that she has noticed an intermittent bluish discoloration of the baby's lips, tip of the nose, and ears. Physical examination of the infant is negative for cardiac murmurs and abnormalities on lung auscultation. You note a below‑average weight gain. Feedings consist of 4 ounces of diluted formula every two hours. The infant has occasional loose stools. You instruct the parents to increase caloric feedings, which should include vitamin and mineral supplements. You tell the parents to call you immediately if any further episodes of the bluish discoloration occur.

Approximately three weeks later, the baby's frantic parents call your office; the infant is crying incessantly and has vomiting and profuse diarrhea.

Vital Signs

When the baby is brought to your clinic a few minutes later, she is afebrile but has tachypnea, central cyanosis, and drowsiness. You note her vital signs as follows

* blood pressure (BP) = 78/30 mm Hg (normal 50th percentile for her age is 80/46 mm Hg)
* heart rate = 140 beats/minute
* respiration = 40 breaths/minute

Additional Information

An ambulance is summoned and 100% oxygen is administered by face mask. No improvement in the cyanosis is noted on her arrival at the hospital emergency department.

Emergency Treatment

The examining emergency physician now notes a grade II/VI systolic murmur and central cyanosis, which has not improved despite administration of 100% oxygen for nearly 1 hour. The infant shows no evidence of cardiac failure, atelectasis, pneumonitis, or pneumothorax. Treatment with methylene blue is started, which results in a dramatic resolution of the cyanosis. The infant is discharged on the second hospital day with no evidence of central nervous system hypoxic damage.

**Case 6**

A 52-year-old man comes to your office for a health evaluation, his first in 3 years. While trying to assure you that he is in reasonably good health, he admits that his wife prompted this visit. She is concerned about his weight loss, lack of stamina, and weakness in the shoulders and arms. When you review his chart, you see that he has lost 30 pounds since his last visit. The patient also describes shortness of breath with moderate activity. He is a lifelong nonsmoker and drinks alcohol only occasionally. He is taking no medications. His past medical history is noncontributory. A review of systems reveals that the patient also has a chronic, intermittently productive cough, which has been ongoing for 1 month.

The patient has worked at a coal tar manufacturing plant for the past 34 years. He has been a lifelong resident of an urban industrial neighborhood that is approximately 1 mile from where he works. He has been married for 25 years. His wife and adult daughter are in good health.

A physical examination shows that his vital signs are normal. An inspection of his skin reveals multiple dry, scaly, hyperpigmented macules involving the forehead, temporoparietal areas, eyelids, and brows, and several hyperkeratotic papillomata on his face, neck, upper chest, forearms, and hands. Palpation of the right supraclavicular area reveals a firm, nontender, fixed lymph node 2 x 3 centimeters (cm) in size. Auscultation discloses intermittent, scattered, right-sided wheezes and dry bibasilar crackles. The remainder of the exam is unremarkable.

The patient’s laboratory results are remarkable for the following:

1. hemoglobin = 12.9 grams per deciliter (g/dL) (normal = 14–18 g/dL);
2. hematocrit = 36% (normal = 42%–52%);
3. leukocyte count = 2.9 x 10³ per microliter (µL) (normal = 3.9–11 x 10³/µL);
4. serum calcium = 12.9 milligrams per deciliter (mg/dL) (normal = 8.5–10.5 mg/dL);
5. alkaline phosphatase = 483 international units per liter (IU/L) (normal = 30–125 IU/L) with concomitant elevation of GGTP (GGT);
6. SGOT (AST) 121 IU/L (normal = 7–45);
7. SGPT (ALT) 129 IU/L (normal = 7–35 IU/L);
8. The chest radiograph reveals a 3.3-cm central, thick-walled, cavitating lesion with irregular, spicular margins in the right upper lobe, and atelectasis and prominence of the right hilar lymphatics.

**Case 7**

A 37-year-old woman who is four months postpartum is seen at your office with complaints of headache, increasing irritability, and difficulty concentrating. She says she has become impatient and short-tempered with her husband and new child; minor things make her angry. These feelings began about one month ago. She is most aware of them in the evenings, when they are sometimes accompanied by a throbbing frontal headache. She has no psychiatric history. She has been drinking three ounces of alcohol a day since her marriage four years ago. She did not drink during the pregnancy and does not use other drugs or medications. She has had no trouble sleeping.

Two weeks ago the patient and her family visited her parents for a week. During that time she felt well; the irritability and headaches subsided. Since she returned home last week, however, the symptoms have returned.

The patient is worried that something in the home is causing her symptoms. She reports that the house was sprayed for termites two years ago, but she does not remember the name of the pesticide used. Her husband feels fine and has not been ill. Her infant daughter's delivery was uneventful and the baby appears to be developing normally, but has been “very fussy” lately. The infant, whom you saw five weeks ago for otitis media, is still breast-feeding.

One month ago the patient returned to her job as a word processor. She works mornings and relaxes with her hobby, silk screening, in the afternoons. She gets along well with her employer and fellow employees, and the job is not generally stressful. However, she is concerned that a loss in typing accuracy and a decreased ability to concentrate may lead to conflict with her supervisor. The patient has no symptoms of postpartum depression and had no history of headaches before she resumed these activities.

**Physical Examination**

On physical examination, you find that the woman is slightly overweight. Her nail beds are pale. She has no skin rashes, lesions, or stigmata of liver disease. The conjunctivas are mildly injected, but the nares and oral mucosa are not swollen or injected. The thyroid is not enlarged, and no lymphadenopathy is present. She has no focal muscle tension or tenderness. Her liver is not enlarged and examination of the abdomen is unremarkable. Neurological examination results are within normal limits. Recent and distant memories are intact. Proverb interpretation and Mini-Mental State Examination results are normal. Sensory and motor functions are normal, as are Romberg test results and gait. Deep tendon reflexes are normal and symmetrical.

* Blood pressure: 125/85 mmHg
* Pulse: 68 beats/minute and regular
* Temperature: normal

**Case 8**

A 28-year-old pregnant female comes to your office in the late afternoon with complaints of coughing spasms, chest tightness, and a sensation of being unable to breathe. These symptoms began about 6 hours earlier, while she was repainting a disassembled bicycle with an acrylic lacquer spray paint in a small, poorly ventilated basement area. The painting took about 2 hours to complete.

The patient also experienced nausea, headache, dizziness, and lightheadedness, which cleared within an hour after leaving the basement area. The chest and respiratory complaints, however, have persisted, prompting the office visit. She is concerned that her symptoms are related to the paint spraying and might affect her pregnancy.

Vital signs include blood pressure 116/80, heart rate 90/minute at rest, respiratory rate 22/minute, and temperature 98.8°F. There are no orthostatic changes in pulse or blood pressure. The head, eyes, ears, nose, and throat (HEENT) examination is negative except for very mild scleral injection. There are mild expiratory wheezes throughout both lung fields, but no rales and no abnormal findings on percussion. Spirometry shows a forced expiratory volume in 1 second (FEV1) of 72% of predicted value and a moderately decreased peak expiratory flow rate of 275 liters (L)/minute. The FEV1 /forced vital capacity is 75%. There is no cyanosis. Cardiovascular and neurologic examinations are normal. The abdomen is soft and nontender, and a bimanual pelvic examination reveals a 16-week gravid uterus. There is no vaginal bleeding, and no adnexal masses are present. On questioning the patient further, you discover that 2 years ago she was exposed to fumes of toluene diisocyanate (TDI) from an accidental spill during her work as a bookkeeper at an industrial research laboratory. The patient had only eye and upper airway irritation at the time of the accident but developed severe shortness of breath and coughing 4 hours later. She was hospitalized for several days but recovered.

**Case 9**

During 1979-1993, the man frequently visited Haiti. After temporarily residing in Haiti during most of 1993, the man returned to Miami in December. During February 1994, he sought medical care for severe neck pain and headache; he was treated as an outpatient and returned to Haiti in March. On April 19, after returning to the United States, he presented to a hospital in Miami with acute renal failure attributed to mild mesangial proliferative glomerular nephritis and was hospitalized. He recovered following hemodialysis and was discharged on April 29.

During May 1994, he made four visits to the hospital's outpatient clinic for different problems, including frontal headache, acute anxiety, epigastric pain, and chest and back pain. During each visit, he also complained of pain in the neck, extremities, or back. Negative diagnostic studies during these visits included an electroencephalogram, electrocardiogram (ECG), and magnetic resonance imaging (MRI).

On June 9, he presented again with a 6-day history of neck pain, headaches, photophobia, feverishness, nausea and vomiting, and right-sided weakness. He was hospitalized and started on ceftriaxone for presumed meningitis. Laboratory studies included a white blood cell count of 10,300/mm3 (normal: 5000-10,000/mm3), hemoglobin of 12 g (normal: 14-18 g), and hematocrit of 36 units (normal: 40-54 units); findings were within normal limits for chest radiographs, ECG, and a brain MRI. Cerebrospinal fluid obtained by a lumbar puncture was clear with a protein level of 16 mg/dL and glucose of 111 mg/dL. The patient was started on acyclovir and high-dose steroids for presumed central nervous system vasculitis. Because of progressive lethargy and disorientation, he was admitted to the medical intensive care unit (MICU); two computed tomographies of the head done on admission on June 9 and again on June 11 were negative for evidence of a cerebrovascular event or meningeal involvement.

The patient's neurologic function continued to deteriorate, and despite mechanical ventilation, he died on June 21. Hypersalivation was not a documented symptom during the clinical course.

On July 13, microscopic examination of brain tissue taken at autopsy showed diffuse, severe encephalomyelitis

**Case 10**

On May 16, a boy aged 6 years who lived in Colorado went to a Texas hospital with a 2-day history of diarrhea and shortness of breath. On initial examination, the child had cyanotic lips and nail beds, with cold extremities. His pulse was 163, and his temperature was 101°F (38.3°C). Soon after arrival at the hospital, the child became apneic and had no palpable pulse. Chest compressions were initiated, and the child was intubated and ventilated. A chest radiograph revealed bilateral infiltrates, and blood analysis demonstrated elevated hematocrit, elevated WBC count, and thrombocytopenia. Within 2 hours of admission to the hospital, the boy died from apparent cardiac failure secondary to shock. The child had been treated with intravenous fluids, ceftriaxone, epinephrine, atropine, and albuterol. The working diagnosis at the time of the child's death was shock and sepsis caused by pneumonia.

An environmental assessment conducted at the boy's home in Colorado found rodent droppings and nesting materials under his bed and in bushes in front of the home where the boy had played.

**Case 11**

On June 7, an adolescent boy aged 14 years went to a Washington emergency department with a 5-day history of shortness of breath, chest pain, cough, and fever. Upon admission, the child had a fever of 103°F (39.4°C), pulse of 100, and a respiratory rate varying between 40 and 60. He was thrombocytopenic and had elevated WBC with atypical lymphocytosis. A chest radiograph revealed bilateral interstitial infiltrates. No details were provided regarding treatment or any suspicion of HPS.

Because of worsening respiratory distress and hypoxia, the patient was intubated and mechanically ventilated for approximately 24 hours. He improved and was discharged home on June 13.. A follow-up environmental assessment found rodent fecal contamination in a container of corn that the youth reported hand-grinding 8 days before illness onset.

**Case 12**

On July 12, a boy aged 6 years went to a Colorado emergency department with a 5-day history of fever (maximum 103°F [39.4°C]), erythematous facial rash, and myalgia. Upon admission the boy's pulse was 120, respiratory rate 48, and oxygen saturation 72% on room air. Dyspnea was apparent with coarse breath sounds, wheezes, and crackles on auscultation. His WBC count was elevated, and thrombocytopenia was noted. A chest radiograph revealed bilateral diffuse pulmonary infiltrates with pleural effusions. HPS was suspected, and the boy was treated with intravenous fluids, ceftriaxone, and azithromycin.

The boy was intubated and mechanically ventilated from July 12 to July 20; he was discharged on July 22. Family members reported that approximately 10 days before hospitalization the child was bitten on the finger by a mouse. During environmental assessment, evidence of rodent infestation was observed in outbuildings and abandoned vehicles but not within the house.

**Case 13**

On July 12, a girl aged 9 years living in Arizona went to a New Mexico hospital with chest pain and shortness of breath. Symptoms began with abdominal discomfort on July 6, which was followed by headache, vomiting, and myalgia. Upon examination, the girl's temperature was 99.9°F (37.7°C), and her pulse was 162. Laboratory findings included thrombocytopenia, elevated hematocrit, and elevated WBC count. A chest radiograph revealed diffuse interstitial infiltrates. During transport to a tertiary care facility for further treatment, the child's temperature reached 103.8°F (39.9°C). HPS was suspected, and the girl was treated with intravenous fluids, ceftriaxone, and vancomycin.

Because of worsening signs of pulmonary distress, the girl was intubated and received extracorporeal membrane oxygenation therapy for 4 days. She remained on a ventilator until July 22 and was hospitalized until August 5. Evidence of rodents was found at three residences frequented by the girl in Arizona: the family home, grandparents' home, and a summer home where she played in an underground dugout that had rodent burrows.